PATENT ABSTRACTS OF JAPAN

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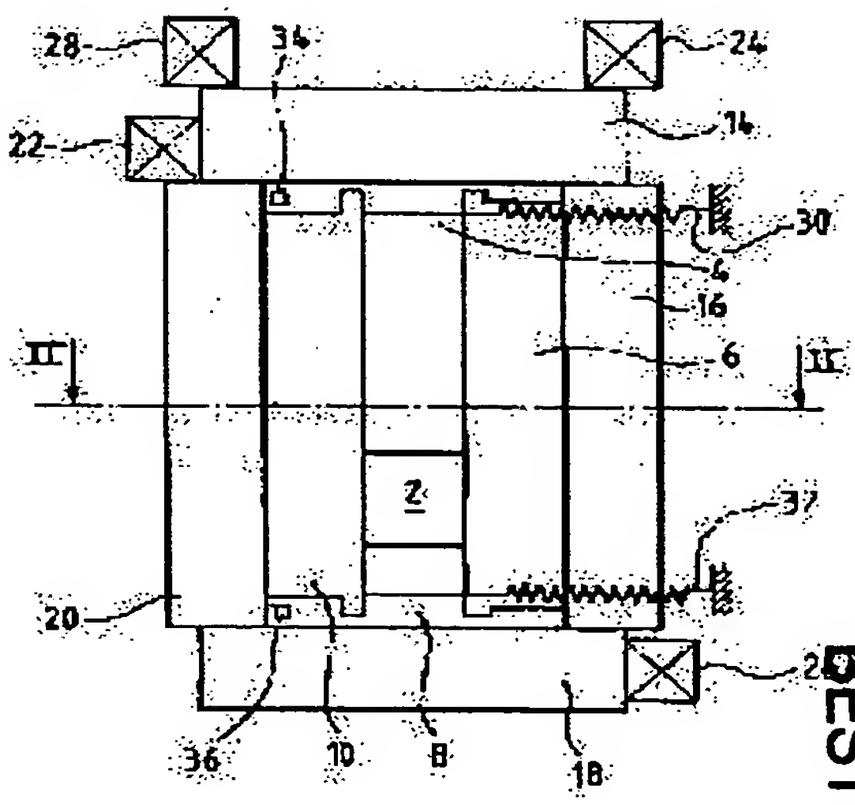
(54) ADJUSTABLE COLLIMETER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a collimeter whose opening can be asymmetrically adjusted to be useful for mammography (mammal radiography).

SOLUTION: This is a collimeter for radiography which has an opening (2) formed by edges of four flexible shutters (4, 6, 8, 10). Shutters (4, 6, 8, 10) can be independently moved. Accordingly a position and a size of the opening can be arbitrarily adjustable. Shutters (4, 6, 8, 10) are moved by winding up those around drums (14, 16, 18, 20) respectively. Drums are respectively moved by stepping motors (22, 24, 26, 28). Shutters (4, 6, 8, 10) are shifted to a closing position of the collimeter by springs (30, 32).



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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the top view of a collimator.
[Drawing 2] It is the sectional view of the collimator of drawing 1 .
[Drawing 3] It is the enlarged drawing of the edge of the shutter in the collimator of drawing 1 .
[Drawing 4] It is a sectional view by another collimator.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to radiation equipment called X-ray emission equipment and the collimator meant by the detail at use with such equipment more.
[0002]
[Description of the Prior Art] In an X-ray plant, a radiation is emitted from one point of a line source. A radiation takes the gestalt of the cone to which it points towards a photographic plate or an X-ray induction sensor called a digital detection means towards analyte. Generally a cone has a larger dimension than the dimension of analyte or a detection means in a longitudinal direction. A collimator is equipment with which it is placed between a line source and analyte, a part of X-ray is intercepted, and a radiation is applied to analyte by it only in the field corresponding to the inside or the sensor of an inspection zone. A collimator can be adjusted in order to enable various inspection.
[0003] Such a collimator is indicated by U.S. Pat. No. 3,668,402. A collimator is constituted in the patent by two web assemblies which do not let an X-ray pass. Each web assembly has one pair which forms the continuation loop formation stretched over one pair of drums of webs (textiles) estranged and combined. These two assemblies are in the condition to which another side and one drum pair crossed at right angles, and as one side is on another side, they are constituted. The edge of the web which one assembly meets for each other forms the edge which rectangle opening which can pass an X-ray meets. The edge of the web of the assembly of another side forms other two edges of rectangle opening. The adjustment for changing the opening size of a collimator is made by making one side of an assembly roll round on a drum. or [that the edge which the web of the assembly meets by being wound is brought more close] -- or it is pulled away.
[0004] This collimator has the disadvantageous profit which obtains unsymmetrical opening that things cannot be carried out. Rotation of a web assembly produces coincidence migration in the distance same about the edge which collimator opening meets which is an opposite direction. Consequently, opening is always symmetrical about the shaft of a cone X-ray beam. Furthermore, a collimator is larger than maximum-mandibular-movements size. In the location of the maximum collimator opening, the edge of a certain web spreads in overlap, and a web spreads between the pairs of the drum.
[0005]
[Problem(s) to be Solved by the Invention] Therefore, the need for the collimator which opening can adjust asymmetrically exists. Such unsymmetrical opening especially is useful to a mammography (udder roentgenography). It is difficult to guarantee that the organ to inspect is actually easily moved with such equipment, and it is suitably positioned on a system on the shaft of an X-ray beam.
[0006]
[The outline of invention] In the operation gestalt of this invention, a collimator has four flexible shutters which form the edge of collimator opening. Each shutter can be moved independently of other shutters.
[0007] In this structure, the location of each edge of opening can be adjusted independently. Unsymmetrical opening can be obtained by using this collimator. Collimator opening may be adapted for the body or organ to inspect, restricting radiation to the exterior of a body or an organ. A body or an organ does not need to be directly placed on the shaft of an X-ray beam.
[0008]
[Embodiment of the Invention] The collimator which followed 1 operation gestalt of this invention drawing 1 and 2 is shown. A collimator has opening or the collimation field 2 through which an X-ray passes. This opening has a rectangle configuration. A rectangular dimension can be adjusted. Furthermore, each rectangular side can be moved independently of other rectangular sides. A collimator has four flexible shutters 4, 6, 8, and 10. A shutter is made from the ingredient which does not let a radiation pass. Moreover, the ingredient is flexible, namely, it may be rolled round by a drum or the roller so that it may explain below. The metal foil or the synthetic-rubber ingredient which contains a

metal filler in alternative can be used for an ingredient. The flank or the edge of a shutter constitutes the edge of collimator opening. The edge 12 of a shutter 4 forms the top edge of collimator opening.
[0009] Each shutters 4, 6, 8, or 10 are rolled round by each drum 14, 16, 18, or 20 prolonged almost in parallel with the edge of a shutter. It is guaranteed that the edge of a drum and a shutter is parallel and a dimension becomes as close to maximum-mandibular-movements size as possible outside a collimator. Each drum rotates independently and is driven. In the illustrated operation gestalt, motors 22, 24, 26, or 28 are formed in each drums 14, 16, 18, or 20, respectively. A motor is a stepping motor which rotates and drives the drum connected, for example. Since each drum has each separate motor, each of the shutter of a collimator may be moved independently. Collimator opening can be made into the size of all requests, and can be arranged in the location of a request of the arbitration in the space formed between drums. In the example of drawing 1 , a collimator is horizontal and symmetrical. That is, the vertical axes of the symmetry of opening are in the midpoint between drums 16 and 20. Contrary to this, a collimator is not symmetrical in a perpendicular direction. There is no horizontal axis of the symmetry of opening in the midpoint between drums 14 and 18, and it is closer to a drum 18 than a drum 14. Consequently, it is possible to move collimator opening caudad, maintaining the aperture of opening of fixed extent. This has the following advantages in test equipment. A patient or analyte can be arranged in the analysis field, without caring about those locations to a beam shaft. Then, collimator opening may be adapted for the tested part, without moving a tested part. In the example of drawing 1 , arrangement of the tested part will be able to be carried out rather than a drum 14 towards a pars basilaris ossis occipitalis soon at a drum 18, and collimator opening is moved caudad. When a shutter 8 falls, it is not necessary to raise a shutter 4. Fewer radiations are applied to a patient.
[0010] In the example of drawing 1 , the spring toward which a shutter is biased so that it may meet mutually can be prepared. Drawing 1 sketches such springs 30 and 32 about the shutter 10. The spring of other shutters is not illustrated. Existence of a spring serves as a safeguard of a collimator when a drum motor should break down or stop, the shutter which counters contacts mutually, and a collimator is closed. Therefore, a collimator will be closed if a problem is in a shutter motor. A certain sag which is produced by rolling up of a shutter and which may take place also removes a spring again. The spring illustrated by the drawing is elongated when a shutter is rolled round by the drum. The spring compressed between rolling up of a shutter can also be prepared.
[0011] The collimator shown in drawing 1 operates as follows. In order to form predetermined size and opening of a location, a motor operates. Each shutter is rolled round by the self drum as a function of the location of a request of an edge where the collimator opening 2 corresponds. A calibration is the manufacture phase of a collimator and can be performed by constituting the table of a shutter location and a motor halting point. Moreover, it is also possible by opening a collimator completely, namely, rolling round each shutter completely to initialize and process a collimator shutter location. In the example of drawing 1 , the contact section for restricting rolling up of a shutter called the stops 34 and 36 of a shutter 10 can be prepared. In this case, rolling up of the shutter to the location of maximum mandibular movements brings them to a position, and that location is completely determined by the contact stop. An index with an exact shutter location is obtained with extent of rewinding [of the shutter from this position]. Furthermore, when a digital detection means is used for televising of an image, a shutter location can be recorded on the supplied image. Consequently, a shutter location can be checked at the time of each exposure.
[0012] Drawing 2 shows the cross section which passes along the collimator of drawing 1 along with line II-II of drawing 1 . This flat surface is parallel to drums 14 and 18, and is a flat surface which crosses drums 16 and 20. About drawing 1 , it mentioned already, for example, those components, such as a shutter and a corresponding drum, will be accepted in drawing 2 . Drawing 2 shows subordinately that it is in a different flat surface in the shutters 4 and 8 about one part, and the shutters 6 and 10 about the part of another side. Moreover, drawing 2 is illustrating not only the part 40 of the beam which passes collimator opening but the line source 38 of an X-ray.
[0013] Drawing 3 shows the cross section in the magnifying power of the edge of a shutter. The shutter 6 is constituted by the flexible sheets 42 and 44 of two sheets with which one side was placed on another

side. This configuration is advantageous especially when a shutter is a synthetic-rubber ingredient. In that case, there may be inclusion which makes it transparence to an X-ray in a shutter. When there are two piled-up layers, the probability used as the case where a shutter has the clearing point becomes low. The inclusion in both layers cannot hardly be correctly in agreement in fact. Drawing 3 also shows again that an insert or the additional components 46 are formed in the edge of a shutter. This component can be based on the ingredient which does not let an X-ray called a metallic material pass. The existence is concerned with the number of the layers which constitute a shutter, and guarantees the sharp edge [be / nothing] of an X-ray image in the first place. When a shutter consists of two-layer, this component is useful also in order to hold a layer to one. Since the spring of the format described about drawing 1 is fixed again, it can be used.

[0014] Drawing 4 shows the cross section by another example of a collimator. The collimator of drawing 4 differs from the thing of drawing 1 -3 in that a shutter is not rolled round by the direct drum. In the example of drawing 4 , it is prepared instead of rollers 48 and 50 being drums. A shutter 6 is only supported by it towards a drum 52 between the stroke, without being rolled round by the roller 48. In this example, the drum which rolls round a shutter does not have near in the flat surface of a shutter any longer, and can consist in the flat surface offset to the shutter flat surface. The advantage of the example of drawing 4 is as follows. In the first place, a roller occupies space fewer than a drum. Therefore, the longitudinal direction dimension of a collimator is smaller than drawing 1 and the example of 2 about collimator opening of arbitration. As drawing 4 shows [second], it is not required for a shutter to be rolled round by the drum. It can become enough [using a transfer member called the wire 54 which is fixed to a shutter and wound around a drum]. Consequently, this example restricts torsion which a shutter receives. In this case, it is possible to use the drum which has an outer diameter smaller than what was shown in drawing 1 and the example of 2. In this example, like drawing 1 and the example of 2, a drum drives a shutter, and in order that each shutter may enable it to move independently, it is prepared.

[0015] Drawing 1 and 2 are illustrating rectangle opening. What has trapezium opening or a rhombus can be prepared by making a drum incline to mutual. Although the collimator of the indicated operation gestalt is applied to an X-ray plant, it can also be used with the equipment which emits the radiation of other classes. On the other hand, the example of the drive shown in drawing 1 and 2 and the example shown in drawing 4 on the other hand are mixable. In this case, some of shutters are directly rolled round by the drum and other things are driven on a drum through a roller.

[0016] This contractor can perform without various corrections in structure, a process, and/or a function deviating from the range of this invention indicated by the claim.

[Translation done.]

CLAIMS

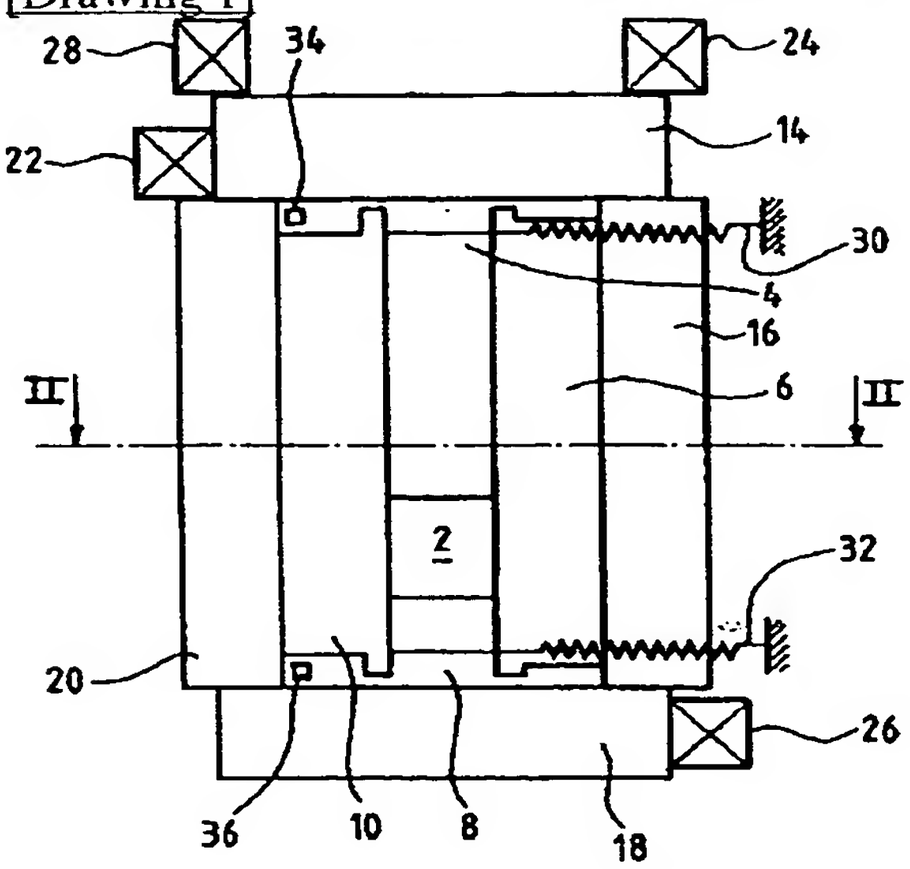
[Claim(s)]
[Claim 1] The collimator which has opening (2) by which each shutter is formed by other shutters and the independently movable edge of four movable flexible shutters (4, 6, 8, 10).
[Claim 2] The collimator according to claim 1 with which a shutter (4, 6, 8, 10) is rolled round by the drum (14, 16, 18, 20).
[Claim 3] The collimator according to claim 1 with which the shutter (6) is connected by at least one transfer member (54) rolled round by the drum (52).
[Claim 4] The collimator according to claim 1, 2, or 3 with which the shutter (10) is ** carried out towards the shutter (6) which meets with an elastic means (30 32).
[Claim 5] The collimator according to claim 1 to 4 which restricts the variation rate of the shutter which a stop member (34 36) leaves and moves from the shutter which meets.
[Claim 6] The collimator according to claim 1 to 5 with which a shutter consists of two-layer [which one side has on another side] (42 44).
[Claim 7] The collimator according to claim 1 to 6 with which metal components (46) are prepared in the edge of a shutter.
[Claim 8] The radiation source (38) and equipment equipped with a collimator according to claim 1 to 7.

[Claim 9] How to be the approach of collimating the radiation from a line source, and include the process which forms the collimator which has opening (2) formed by the edge of four movable flexible shutters (4, 6, 8, 10), and the process to which each shutter is moved independently of [in order to adjust collimation opening] other shutters.
[Claim 10] It is the approach according to claim 9 an initialization process includes that a shutter opens a shutter to a stop member and the location where it hits by the process by which the location of a collimator shutter is initialized preceding with a migration process.

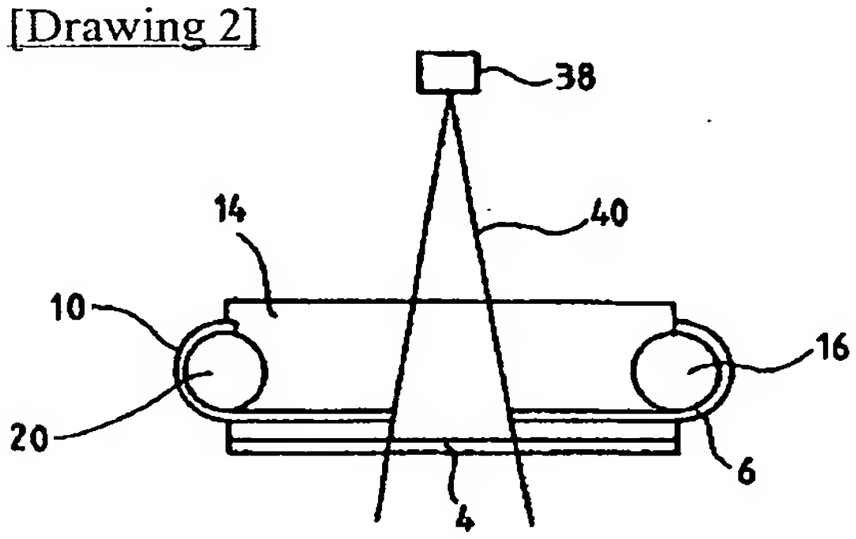
[Translation done.]

DRAWINGS

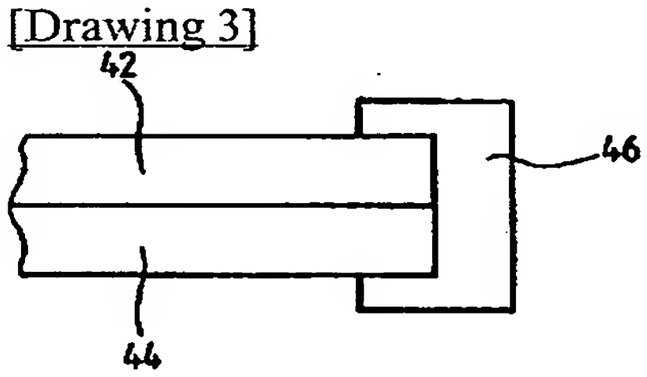
[Drawing 1]



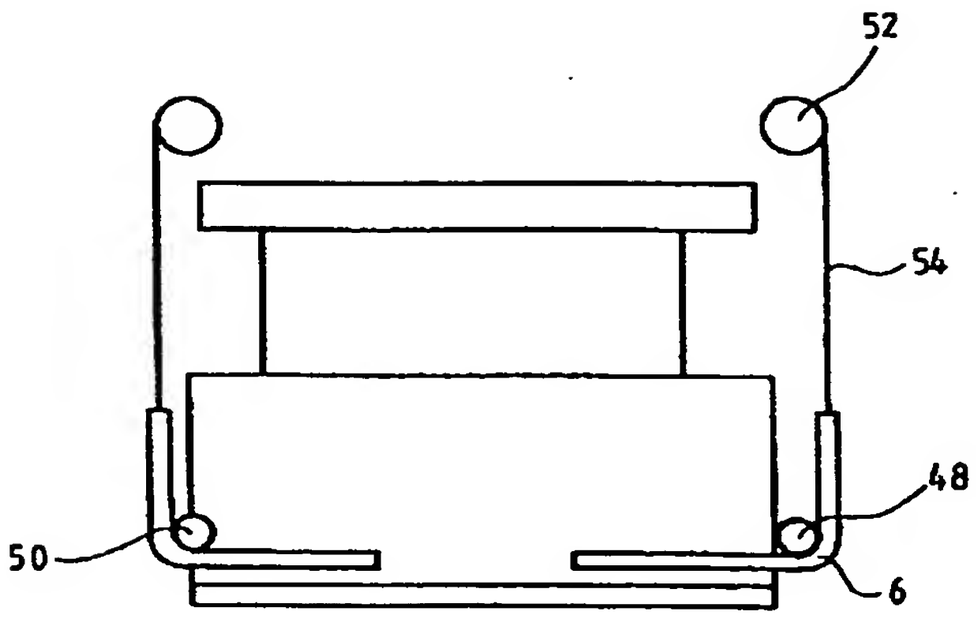
[Drawing 2]



[Drawing 3]



[Drawing 4]



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